REMARKS/ARGUMENTS

This is in response to the Office action of February 27, 2004 to which a three month extension of time has been requested.

Reconsideration of this application is respectfully requested.

The amendment takes into account the following changes to the application.

The disclosure is objected to because of the following informalities:

1. the title does not accurately describe the invention being claimed;
2. application fails to contain a brief description of the drawings; and
3. figures 10A and 10B do not appear to be described in the specification. Although Figures 6-9 have been mentioned in the specification figures 6a, 6b, 7a, 7b, 8a, 8b, 9a, and 9b have not been individually mentioned.

Applicant has revised the title and specification accordingly.

The Office action indicates that claims 11 and 16 are rejected under 35 USC § 112 because the specification does not reasonably provide enablement for the removal of zinc, iron or manganese radioactive metal ions. Claims 11 and 16 are cancelled without prejudice.

Claims 1-6 have been rejected under 35 USC § 103 as being unpatentable over Bedart (U.S. Patent 5,858,243). The Examiner alleges that the reference discloses removing contaminate metal ions of the type recited in the claims making reference to column 5, lines 29-32 from an aqueous stream such as that recited in column 1, lines 14-15 with a crystalline silicate material reciting column 2, lines 49 and 53 containing niobium tantalum, antimony or mixtures thereof citing column 2, lines 59-61. This

rejection is respectfully traversed.

The present invention is a method of extracting aqueous metal ions from an aqueous solution by contacting the aqueous solution with a material comprising an antimony silicate that has been doped with one or more elements selected from the group consisting of tungsten, niobium and tantalum. Several dependent claims make reference to ratios between silicone and antimony. Other dependent claims make reference to the fact that the metal ions are radioactive ions.

A preferred embodiment in the application describes the preparation of the antimony silicate material by reacting in a liquid medium the silicone containing compound and an antimony containing compound in the presence of an acid; see for example paragraphs [0027] and [0039]. This has formed the basis of new claim 17. In addition dependent claim 18 indicates that the catalyst is a polymerization catalyst.

The prior art on the other hand is particularly concerned with zeolite type materials that are titanium silicate materials. The '243 reference indicates that the titanium is a critical element and must be present in the novel molecular sieves disclosed in the '243 case. Nowhere in applicant's specification is titanium mentioned. Nowhere in applicant's claims is titanium mentioned. The entire '243 specification is solely directed towards molecular sieves which have a structure which is an inter-growth of the pharmacosiderite and sitinakite structures (column 2, lines 19 and following). Pharmacosiderite is an iron arsenate of the formula $Fe_3(AsO_4)_2(OH)_3 \cdot 5H_2O$, according to *McGraw-Hill Dictionary of Scientific and Technical Terms, 5th Edition*, 1994 (attached). The material sitinakite is likewise a titanium silicate material. The *Google* website

(attached) gives general information as to the chemical formula and the composition. Quite simply, the prior art is particularly concerned with titanium silicate materials. There is an ever so brief mention as to the material containing antimony in the '243 patent. This is diametrically opposed to the present application where antimony silicates are prepared and antimony and silicone are principal elements of the material utilized in the extraction process. Applicant's materials are not suggested in the '243 reference and would not be because titanium is a critical element of the '243 patent.

It is respectfully submitted that antimony is not enably disclosed in the '243 patent. Note that antimony is not described in any working example nor is it related to the working examples where niobium oxide is synthesized. The working examples only discuss the use of a niobium oxide. There is no reason for antimony being present with the mixtures of material described in the '243 patent and there is no working example that would suggest that it in effect could be prepared in such a fashion. It should also be noted that the preparation of the novel molecular sieves (column 2, line 22) of the '243 patent requires utilization of an alkaline pH. Note that the working examples show that the pH for synthesis of such novel material ranges from 12.89 (Example 1), 12.06 (Example 3) to 11.96 (Example 5). Since titanium is not utilized in the present application and is a critical requirement for the '243 patent it is not seen how the present invention would be obvious in light of that disclosure. In particular, the new claims 17 and 18 are likewise not suggested by the reference.

In summary a proper construction of applicant's claims in light of the specification does not include titanium whereas titanium is a critical element of the art.

The rejection based on the '243 reference should be withdrawn.

On page 4 of the Office action claims 7-16 are rejected under 35 USC 103 as being unpatentatable over Bedard as described above and further in view of Dietz et al (US 5,888,398). This rejection is respectfully traversed. The Examiner alleges that Bedard discloses the claimed invention with the exception of the recited pH for the aqueous stream. The Office action also indicates that it would have been obvious to one of ordinary skill in the art at the time the invention was made to treat a nuclear waste stream having a pH of less than 7 by the process of Bedard since Dietz teaches that such nuclear waste streams are typically acidic.

The deficiencies of Bedard are addressed above. It is respectfully submitted that Dietz has little or nothing to do with the claimed invention of claims 7-16. The '243 patent as indicated above pertains to a rather unique crystalline molecular sieves which have a crystal structure which is an intergrowth of pharmacosiderite and sintinakite structures. The '398 patent is substantially different as a process for extracting cesium ion. The '398 patent uses a crown ether and organic based systems in a liquid-liquid extraction process. The methods of separation of the materials are substantially different. The'398 patent uses organic crown compounds containing substantial amounts of benzene derivatives. Such an extraction system bears no relationship to the primary reference. Therefore, they are not properly combinable.

Further the materials in the primary reference, '243 patent were prepared in a strong basic pH medium. There is no suggestion that the molecular sieves would have any utility in an acidic medium for the molecular sieves may not be operable in such

acidic medium. Lastly, the '398 patent clearly makes reference to the materials as being useful for the isolation of radioactive cesium for nuclear waste streams. However, both the primary and secondary references have co-pendency. It would seem therefore that if the primary reference, Bedard, were to be useful in acidic medium for extraction of radioactive materials it should have been mentioned in the '243 patent. Therefore, the references are not properly combinable and one of ordinary skill in the art would not make such a combination.

Lastly it should be pointed out that the secondary reference '398 patent has no mentioned whatsoever as to the use of antimony silicate materials. This further indicates the lack of applicability of the secondary reference. The rejection over the '398 patent should also be withdrawn.

The Office action on page 4 indicates that US 6,110,378 discloses a similar method for removing contaminate metal ions from an aqueous stream. It is respectfully submitted that the '378 patent has little or nothing to do with the present invention since it is primarily concerned with silicotitanate compositions. As applicant has indicated, titanium cannot properly be construed as falling within the claims of the present invention for the claims do not mention titanium nor does the specification. It is well known that the claims are interpreted in light of the specification. Applicant's invention is directed far more to an antimony silicate and particular ratios of silicone and antimony as called for in the claims.

For the foregoing reasons it is believed that this Amendment places the claims now appearing in this case in condition for allowance, and an early notice to such effect

is respectfully solicited.

In the event that the Examiner does not agree that the claims are now in condition for allowance, he is courteously invited to contact the undersigned at the number given below in order to discuss any changes which the Examiner believes would lead to an allowance of the claims.

A check in the amount of $950.00 is enclosed to cover the request for the three month extension. It is not believed that additional fees are necessitated by the entry of this amendment. However in the event that any new fees or charges are required, authorization is hereby given to charge such fees to applicant's Deposit Account No 50-0852. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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clinoptilolite (a zeolite mineral), sodium titanates (Allied Signal, US), titanosilicate CST (UPO, US) and titanium-oxide based SrTreat (Selion OY, Finland) which work more efficiently in neutral/alkaline media.

Brief Description of the Drawings

[0003a] Figure 1 is a powder x-ray defraction trace of amorphous antimony silicate of the present invention;

[0003b] Figure 2 is a plot of K_d(Sr-85) as a function of pH in 0.1 M $NaNO_3$ of the present invention;

[0003c] Figure 3 is a plot of a comparison of various materials of K_d for Sr-85 of the present invention;

[0003d] Figure 4 is a plot showing the effect of Ca^{2+} on K_D(Sr-85) of the present invention;

[0003e] Figure 5 is a plot showing the effect of Mg^{2+} on K_D(Sr-85) of the present invention;

[0003f] Figure 6a is a plot showing the effect of K^+ on K_D(Sr-85) of the present invention;

[0003g] Figure 6b is a plot showing the effect of K^+ on K_D(Sr-85) of the present invention;

[0003h] Figure 7a is a plot showing the effect of Na^+ on K_D(Sr-85) of the present invention;

[0003i] Figure 7b is a plot showing the effect of Na^+ on K_D(Sr-85) of the present invention;

[0003j] Figure 8a is a plot showing the effect of K_D(Sr-85) in 0.1 M $NaNO_3$ for antimony silicate prepared at various synthesis temperatures of the present invention;

[0003k] Figure 8b is a plot showing the effect of K_D(Co-57) in 0.1 M $NaNO_3$ for antimony silicate prepared at various synthesis temperatures of the present invention;

[0003l] Figure 9a is a plot of K_D (Sr-85) in 0.1 M HNO_3 for antimony silicate prepared at various synthesis temperatures of the present invention;

[0003m] Figure 9b is a plot showing K_D(Co-57) in 0.1 M HNO_3 for antimony silicate prepared at various synthesis temperatures of the present invention;

[0003n] Figure 10a is a plot showing K_D(Sr-85) in 0.1 M HNO_3 for antimony silicate materials with varying Sb:Si ratios prepared at various synthesis temperatures of the present invention;

[0003o] Figure 10b is a plot showing K_D(Co-57) in 0.1 M HNO_3 for antimony silicate materials with varying Sb:Si ratios prepared at various synthesis temperatures of the present invention;

[0003p] Figure 11a is a plot showing K_D(Sr-85) as a function of pH in 0:1 M NaNO3 of the present invention;

[0003q] Figure 11b is a plot showing K_D(Cs-134) as a function of pH in 0.1 M NaNO3 of the present invention;

[0003r] Figure 11c is a plot showing K_D(Co-57) as a function of pH in 0.1 M NaNO3 of the present invention;

[0003s] Figure 12 is a plot showing K_D(Sr-85) for W-doped SbSis as a function of Ca(NO3)2 concentration of the present invention; and

[0003t] Figure 13 is a plot showing W-doped SbSi/Aged for 6 days of the present invention.

Statement of the Invention

[0004] According to a first aspect of the present invention, there is provided a use of a material comprising antimony silicate as a sorbent in the removal of metal ions from an acidic liquid medium.

[0005] The metal ions may be radioactive metal ions.

[0006] The radioactive metal ions may comprise Sr, Cs, Co, Pu or Am ions.

[0007] The radioactive metal ions may be removed from an acidic liquid medium which contains background ions such as Na, K, Mg, and Ca ions at a higher concentration than the concentration of the radioactive metal ions.

[0008] The radioactive metal ions may be selectively removed from the acidic liquid medium which contains background ions such as Na, K, Mg, and Ca ions, the background ions being left behind in the liquid medium.

[0009] According to a second aspect of the present invention, there is provided a method of preparation of a material comprising antimony silicate, the method comprising reacting together in a liquid medium silicon containing compound and an antimony containing compound under polymerisation conditions, characterised in that the mole ratio of Si:Sb is less than about 20 and the reaction product is dried at a temperature from 40°C to 800°C to form the material.